

Notes:

1. PPE: Gloves, lab coat, eye protection
2. Work to be done in fume hood
3. Review Microfluidics Lab HCl SOP before performing this procedure

## Solder Dip-Coating Process Plan

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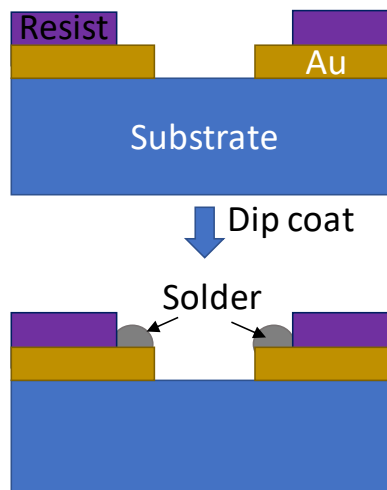
**Aim:** To coat metal pads locally with low melting solder by dip coating. The coated pads will be used to assemble SMDs.

**Materials requirement:** Ethylene glycol with low HCl concentration (just to prevent oxidation) and 47 C metal alloy. (I already have/ordered all these materials).

**Tool's requirement:** An exhaust, a hotplate with thermal sensor, couple of glass beakers, glass bottles, glass pipettes and a waste bottle for ethylene glycol.

**Process details:**

1. I will have substrate like the figure, metal tracks patterned with photoresist. Solder should coat only the exposed area (contact pads). Substrate might be Si or silicones, either.
2. Remove all the solvent from hood during acid mixing.
3. First, heat the ethylene glycol to 60 C with a few drops of HCl (less than 0.1%). This is only for the first run. For next runs, heat the glass bottle/glass beaker directly with solder and ethylene glycol in it.
4. Melt the solder inside the glycol. (Might need to clean/filter the solder bath for first time, the commercial alloy will have lots of residues.) The filtering is done using a glass pipette through pipetting one hot bath to another hot bath.
5. Bring the substrate and dip into the solder bath. (Might need to pipette solder on the pad if the amount of alloy is not enough to completely dip into.)
6. When done, rinse the substrate with normal water (~1 minute under water bath).
7. Remove the temperature probe from the hotplate and rinse in water. Remove the hotplate from the hood when cooled down.



8. Keep the solder bath inside a glass bottle and cool it. Or, if plan to use soon, keep it inside the beaker with a cover and cool it down.
9. The ethylene glycol might need to change frequently, since it will become dirty! Need a waste bottle for that.
10. Remove all chemicals from the hood and store properly.

Next, strip the photoresist using acetone or remover.

Then, assemble the components on the pad and reflow at 60 C, the components will align itself.

#### **Safety precautions:**

1. Use face shield during mixing acid and use apron and safe gloves during the whole process.

#### **Materials and waste storage policy:**

1. Store all the chemicals and waste properly.
2. Waste ethylene glycol with acid should be store in a glass bottle at room temperature.
3. Recycled solder bath should be store in a glass bottle. Maximum amount will be less than 1 liter.
4. Fresh Ethylene glycol can be stores as they arrived from vendor. Maximum storage might be 2-3 liters.
5. Small amount acid (less than 0.5 liter, 40% HCl) can be store in the lab (preferred) or in the cleanroom.

#### **Reference:**

1. SC Park, et al. *A First Implementation of an Automated Reel-to-Reel Fluidic Self-Assembly Machine*, *Advanced Materials* 26 (34), 5942-5949, 2014.
2. SC Park, et al. *Millimeter Thin and Rubber-Like Solid-State Lighting Modules Fabricated Using Roll-to-Roll Fluidic Self-Assembly and Lamination*, *Advanced Materials* 27 (24), 3661-3668, 2015.
3. S. Biswas, et al. *Surface Tension Directed Fluidic Self-Assembly of Semiconductor Chips across Length Scales and Material Boundaries*, *Micromachines* 7 (4), 2016.